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THE VELIGER

A New and Polytypic Species of *Helminthoglypta* (Gastropoda: Pulmonata) from the Transverse Ranges, California

by

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Abstract. A new species of land snail, *Helminthoglypta* (*Helminthoglypta*) ***salviae,*** is described from the Transverse Ranges in southern Kern and northern Ventura counties, California. Two subspecies, differing in shell sculpture and details of coiling, are recognized, *H.* ***salviae salviae*** from Quatal and Apache canyons, and *H.* ***salviae mina*** from the vicinity of Frazier Park.

INTRODUCTION

The following species was first recognized as new by the late W. O. Gregg in the course of his extensive work on the land snails of southern California. Between 1947 and 1957 he and W. B. Miller collected it at several localities east and west of the town of Frazier Park, Kern County. Still earlier, probably some time in the 1930s, George Willett collected a sample of the same taxon near the head of San Emigdio Canyon, Kern County. In April 1984, T. A. Pearce found similar specimens at lower elevations a short distance to the southwest, in Quatal and Apache canyons, Ventura County.

The species remained undescribed because anatomical material was lacking. Species of *Helminthoglypta* can be assigned to subgenus only on the basis of genital anatomy (MILLER, 1985). In April 1986, W. B. Miller, F. G. Hochberg, P. H. Scott, and I secured adequate material for dissection and the species is described below.

Two subspecies are recognized, differing consistently in shell characters but identical in genital anatomy. The basic description below pertains to the species in the broad sense; it is followed by shorter, differential diagnoses and designations of type material for each subspecies and a discussion that again pertains to the species in the broad sense.

The following abbreviations are used: ANSP, Academy of Natural Sciences of Philadelphia; BR, author's collection, San Francisco, California; CAS, California Academy of Sciences; FMNH, Field Museum of Natural History; LACM, Natural History Museum of Los Angeles County; RLR, collection of R. L. Reeder, Tulsa, Oklahoma; SBMNH, Santa Barbara Museum of Natural History; TAP, collection of T. A. Pearce, Berkeley, California; USNM, U.S. National Museum of Natural History; WBM, collection of W. B. Miller, Tucson, Arizona.

SYSTEMATICS

Family HELMINTHOGLYPTIDAE Pilsbry, 1939

Helminthoglypta Ancey, 1887

Type species: *Helix tudiculata* A. Binney, 1843, by original designation.

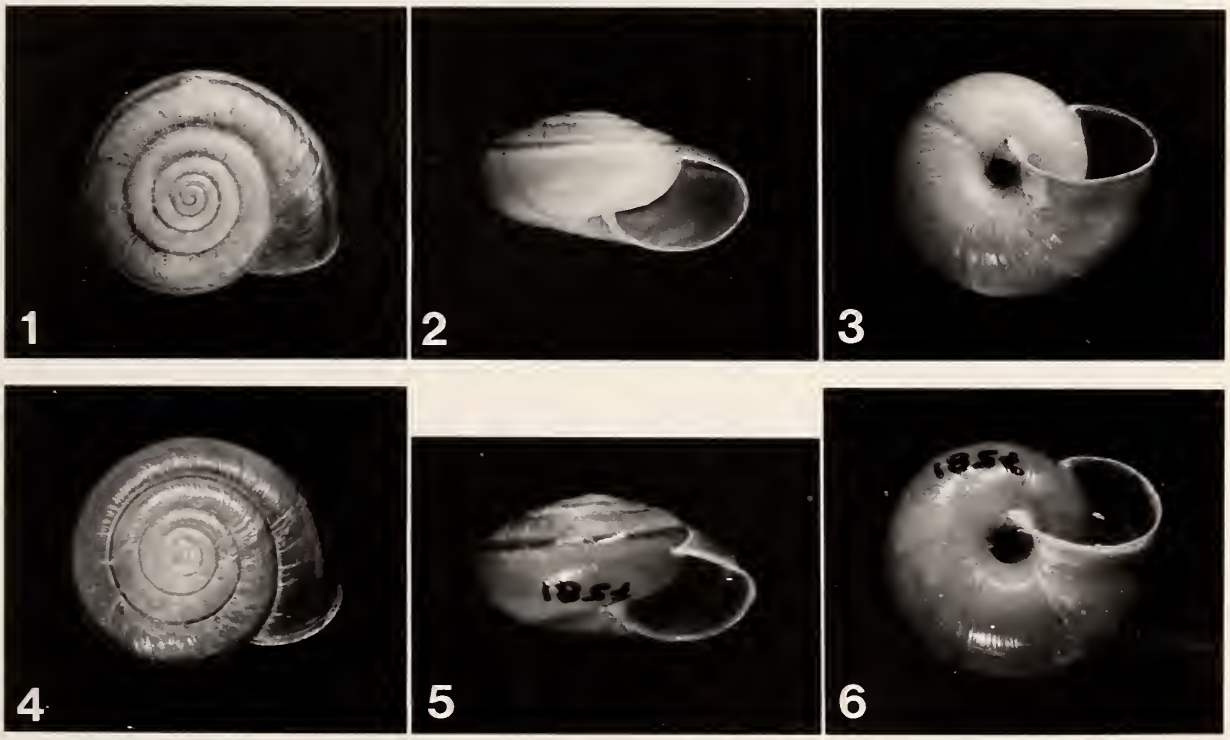
Subgenus *Helminthoglypta s.s.*

Helminthoglypta (*Helminthoglypta*) ***salviae*** Roth, sp. nov.

(Figures 1–8)

Diagnosis of the species: A small *Helminthoglypta* (*Helminthoglypta*) with depressed, matte to glossy, umbilicate, tightly coiled shell, sculptured with minute, slightly wavy, incised spiral striation. Lip thickened but barely turned outward. Dart sac moderately small; common duct of mucus bulbs thick-walled; lower chamber of penis short, conical.

Description of the species: Shell small for the genus, tightly coiled, moderately thin, glossy (in subspecies *H. s. mina*) or matte to silky (in subspecies *H. s. salviae*), depressed, umbilicate, umbilicus contained about 5.3–7.5 (in *H. s. mina*) or 6.8–10.5 (in *H. s. salviae*) times in diameter.



Explanation of Figures 1 to 6

Figures 1–3. *Helminthoglypta* ***salviae salviae***, shell; holotype SBMNH 34872, top, apertural, and basal views. Diameter 16.2 mm.

Figures 4–6. *Helminthoglypta* ***salviae mina***, shell; holotype SBMNH 34876, top, apertural, and basal views. Diameter 15.6 mm.

Spire low to very low-conic, whorl profile low-convex, suture moderately impressed. Embryonic whorls 1.75, set off from teleoconch by a constriction; initially smooth, thereafter with weak, irregular wrinkles radiating from suture, more or less broken up into closely spaced granules on first whorl, and stronger, widely spaced, diagonally arranged, round papillae. Early teleoconch whorls with low, narrow, closely spaced growth rugae (in *H. s. salviae*, some rugae broken up into rows of axially elongated granules) and, from about middle or end of fourth whorl on, a system of closely but irregularly spaced, minute, slightly wavy, incised spiral striae. Striation strongest on shoulder of whorl behind lip, but also continuing over base into umbilical region. Base glossy (to matte in *H. s. salviae*), inflated, tumid around umbilicus. Last ¼ whorl gently descending, not constricted behind lip. Aperture broadly auricular, moderately oblique, peristome at angle of 30° to vertical; lip narrowly, crudely thickened and turned outward but barely reflected except at the columellar insertion. Upper limb of peristome produced and slightly downturned. Inner lip barely encroaching on umbilicus. Parietal callus thin, its surface granular. Shell pinkish tan under a yellowish brown periostracum; with a 0.5-mm wide russet spiral band on shoulder (prolonging trajectory of suture), with traces of paler zones of equal width on either side of the band.

Two subspecies are recognized. The holotype of the nominate subspecies, next presented, is of course the holotype of the species as well.

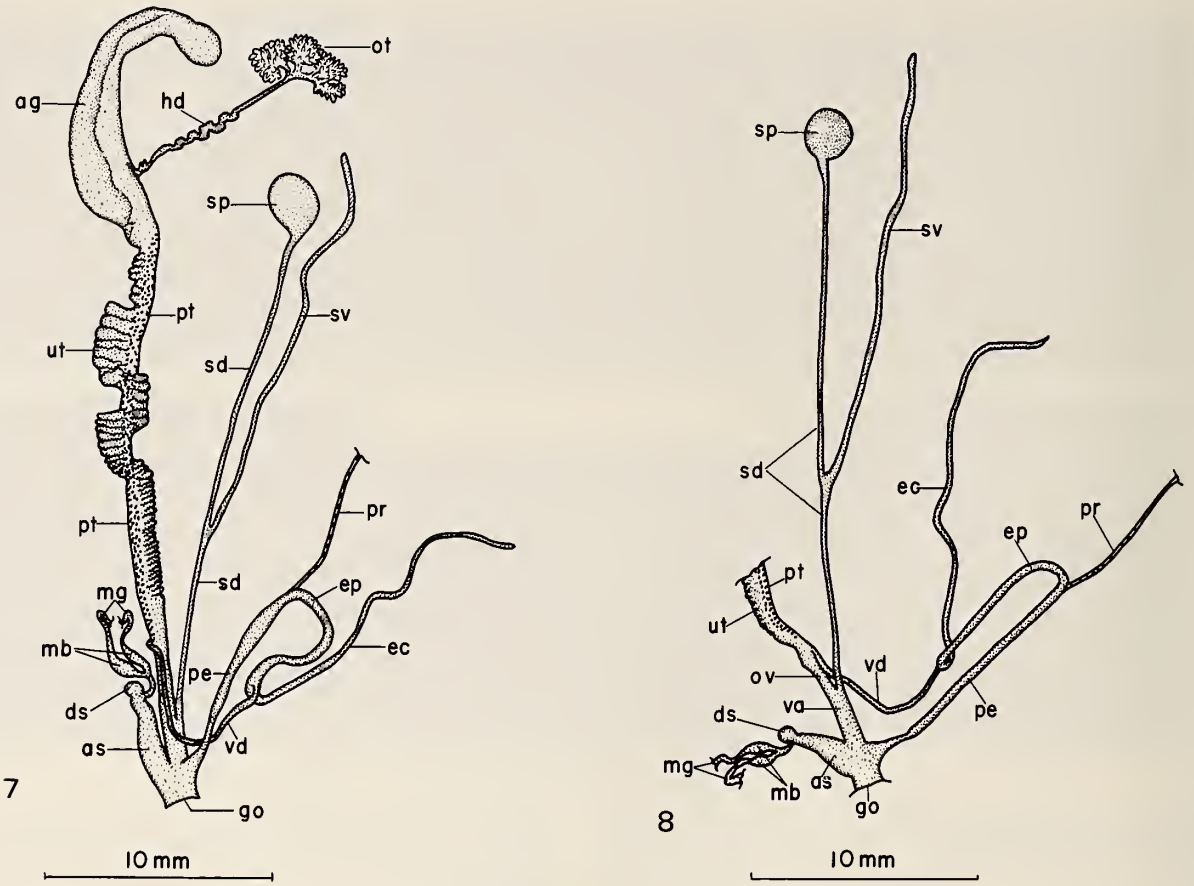
Helminthoglypta (*Helminthoglypta*) ***salviae salviae*** Roth, subsp. nov.

(Figures 1–3, 7)

Diagnosis: Shell matte to silky, umbilicus contained 6.8–10.5 times in diameter. Early teleoconch whorls with coarse growth rugae, some rugae broken up into rows of axially elongated granules. Closely but irregularly spaced, minute, slightly wavy, incised spiral striae present from end of fourth whorl on. Base glossy to matte.

Dimensions of holotype: Diameter (exclusive of expanded lip) 16.2 mm, height 8.6 mm, diameter of umbilicus 2.2 mm; whorls 5.25.

Type material: Holotype: Santa Barbara Museum of Natural History, SBMNH 34872 (shell and dissected soft anatomy), CALIFORNIA: Ventura County: south side of Apache Canyon, 4.0 km west-southwest of Nettle Spring



Explanation of Figures 7 and 8

Helminthoglypta ***salviae***, dissections of reproductive system drawn from projections of stained whole mounts.

Figure 7. *H. salviae salviae*, paratype SBMNH 34874.

Figure 8. *H. salviae mina*, holotype SBMNH 34876; upper part of uterus and prostate removed.

Abbreviations: ag, albumen gland; as, atrial sac; ds, dart sac; ec, epiphallic caecum; ep, epiphallus; go, genital orifice; hd, hermaphroditic duct; mb, mucus gland bulbs; mg, mucus gland membranes; ot, ovotestis; ov, oviduct; pe, penis; pr, penial retractor muscle; pt, prostate; sd, spermathecal duct; sp, spermatheca; sv, spermathecal diverticulum; ut, uterus; va, vagina; vd, vas deferens.

Campground and 10.4 km east of California State Highway 33 [NE¼ sec. 16, T. 8 N, R. 23 W, San Bernardino Base and Meridian], elevation 1280 m; under pine deadfalls and dead yuccas. W. B. Miller, F. G. Hochberg, P. H. Scott, and B. Roth coll., 22 April 1986.

Paratypes: SBMNH 34873 (10 shells and soft parts), SBMNH 34874 (whole mount of stained genitalia), all from same locality as holotype. Additional paratypes deposited in ANSP, BR, CAS, FMNH, LACM, RLR, USNM, and WBM.

Referred material: Additional specimens have been examined from the following localities (all, California: Ventura County): Gully entering north side of Quatal Canyon [NW¼ sec. 22, T. 9 N, R. 23 W], elevation 1400–1450 m; under dead yuccas and under rocks. T. A. Pearce *et al.* coll., 19 April 1984 (TAP). South side of Quatal Canyon [NE¼ SE¼ sec. 33, T. 9 N, R. 23 W]. T. A. Pearce coll., 19 April 1984 (TAP). North side of Apache Canyon, approximately 4.5 mi [7.2 km] west of Nettle Spring Campground, 0.1 mi from road; under dead yuccas. F. G. Hochberg coll., 22 April 1986 (SBMNH). Approximately 0.8 km east of Nettle Spring, Apache Canyon [NE¼ sec. 11, T. 8 N, R. 23 W], elevation 1400–1450 m; under dead yuccas. T. A. Pearce coll., 20 April 1984 (TAP).

Etymology: From the Latin *salvia,* sage, for the Thistle Sage (*Salvia carduacea* Benth.) prominent around the type locality.

Helminthoglypta (*Helminthoglypta*) ***salviae mina*** Roth, subsp. nov.

(Figures 4–6, 8)

Diagnosis: Shell glossy, umbilicus contained 5.3–7.5 times in diameter. Early teleoconch whorls with fine growth

Table 1

Shell dimensions (in mm) and ratios in *Helminthoglypta* ***salviae***. Statistics are range, with mean ± one SD in parentheses. Only adult shells included.

Subspecies	n	D	H	U	W	H/D	U/D
H. s. salviae	22	14.2–18.9 (15.83 ± 1.18)	8.2–10.5 (9.17 ± 0.66)	1.5–2.5 (1.92 ± 0.26)	5.2–5.6 (5.36 ± 0.13)	0.531–0.620 (0.580 ± 0.024)	0.095–0.146 (0.121 ± 0.013)
H. s. mina	60	12.3–20.1 (15.40 ± 1.93)	6.3–11.0 (8.24 ± 1.06)	1.9–3.0 (2.46 ± 0.25)	4.8–5.8 (5.27 ± 0.24)	0.493–0.570 (0.535 ± 0.018)	0.135–0.186 (0.161 ± 0.013)

rugae, not broken up into rows of axially elongated granules. Closely but irregularly spaced, minute, slightly wavy, incised spiral striae present from about middle of fourth whorl on. Base glossy.

Dimensions of holotype: Diameter (exclusive of expanded lip) 15.6 mm, height 8.6 mm, diameter of umbilicus 2.4 mm; whorls 5.4.

Type material: Holotype: Santa Barbara Museum of Natural History, SBMNH 34876 (shell, whole mount of mantle tissue, and whole mount of stained genitalia), CALIFORNIA: Kern County: 6.1 km west of Frazier Park post office, north side of Frazier Mountain Park Road [NW¼ sec. 33, T. 9 N, R. 20 W, San Bernardino Base and Meridian], elevation 1600 m; under rocks loosely seated in soil on south-facing ridge. W. B. Miller, F. G. Hochberg, P. H. Scott, and B. Roth coll., 21 April 1986.

Paratypes: SBMNH 34877 (5 shells), from same locality as holotype, in abandoned wood rat nest, F. G. Hochberg coll., 21 April 1986. North side of Cuddy Canyon [now Frazier Mountain Park] Road 3.8 mi [6.1 km] west of Frazier Park, elevation 5000 ft [1500 m]; under rocks. W. O. Gregg coll., 26 January 1947 (SBMNH 34878), 23 March 1947 (SBMNH 34879), 19 December 1953 (SBMNH 34880). Additional paratypes deposited in ANSP, BR, CAS, FMNH, LACM, RLR, USNM, and WBM.

Referred material: Additional specimens have been examined from the following localities (all, CALIFORNIA: Kern County). The collectors' original topographic measurements, usually expressed in miles and feet, have been preserved, with metric equivalents added.

Head of San Emigdio Canyon, elev. 6000 ft [1800 m], under logs. G. Willett coll. (CAS). (Willett's original label states "Head of S. Emigdio Can., Mt. Pinos," which is internally inconsistent unless "Mt. Pinos" is construed loosely.) North side of Cuddy Canyon, 4 mi [6.4 km] west of Frazier Park School, elevation 5200 ft [1600 m]. W. B. Miller, W. O. Gregg coll., 2 March 1957 (WBM). North side of highway, 1.9 mi [3.0 km] west of Frazier Park; under dead yuccas. W. O. Gregg coll., 1 January 1947 (WBM). Gully north of Cuddy Canyon Road, 1.8 mi [2.9 km] west of Frazier Park, elevation 5000 ft [1500 m]; under granite rocks and rotten wood debris. W. O. Gregg coll., 23 March 1947 (WBM). North side of Frazier Mountain Park Road 1.5 mi [2.4 km] west of Frazier Park; under dead yuccas. F. G. Hochberg coll., 21 April 1986 (SBMNH). Approximately 1 mi [1.6 km] southeast of Frazier Park, near big rock slide, elevation approximately 5000 ft [1500 m]; under yuccas. W. O. Gregg coll., 15 February 1948 (WBM). North of highway, 1.3 mi [2.1 km] east of Frazier Park; under dead yuccas. W. O. Gregg coll., 19 December 1953 (WBM). 1.5 mi [2.4 km] east of Frazier Park, north of bed of Cuddy Creek; under dead yuccas. W. B. Miller, F. G. Hochberg, P. H. Scott, and B. Roth coll., 21 April 1986 (BR, SBMNH, WBM).

Etymology: From the Latin *mina,* bare, smooth.

DISCUSSION

Shell Variation

On 82 adult specimens from 17 lots, representing most of the localities from which *Helminthoglypta* ***salviae*** is known, the following measurements were taken: maximum diameter (exclusive of the expanded outer lip) (D); height parallel to the axis of coiling (H); breadth of the umbilicus parallel to maximum shell diameter (U); and number of whorls (W), counted by the method of PILSBRY (1939:xi, fig. B). Relative height of shell (H/D) and relative umbilical width (U/D) were calculated. Ranges, means, and standard deviations of these variables were calculated for the two subspecies (Table 1). The complete data are on deposit in the SBMNH. The variation was examined by means of principal components analysis (BLACKITH & REYMENT, 1971) with the BMDP Biomedical Computer Program (FRANE & JENNRICH, 1981) at the University of California, Berkeley.

A bivariate plot of relative height (H/D) against relative umbilical width (U/D) (Figure 9) shows that *Helminthoglypta* ***s. salviae*** tends to have relatively higher shells and relatively smaller umbilical width. Slopes of the regression lines for the two subspecies differ significantly from each other ($P < 0.001$).

Five principal components were computed; the first three cumulatively account for 96% (51, 37, and 8% respectively) of the total variance. Table 2 shows loadings of the entered variables. The first principal component is largely an expression of overall size and whorl number; a high score on this factor indicates a large shell with a high whorl count. The raw measures of size (H and D) and whorl

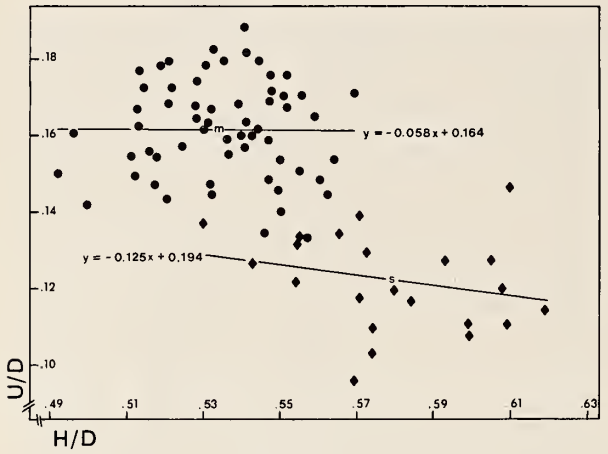


Figure 9

Relation between relative height of shell (H/D) and relative umbilical width (U/D) in 82 adult specimens of *Helminthoglypta* ***salviae***. Diamonds, *H.* ***s. salviae***; circles, *H.* ***s. mina***; s, group mean for *H.* ***s. salviae***; m, group mean for *H.* ***s. mina***.

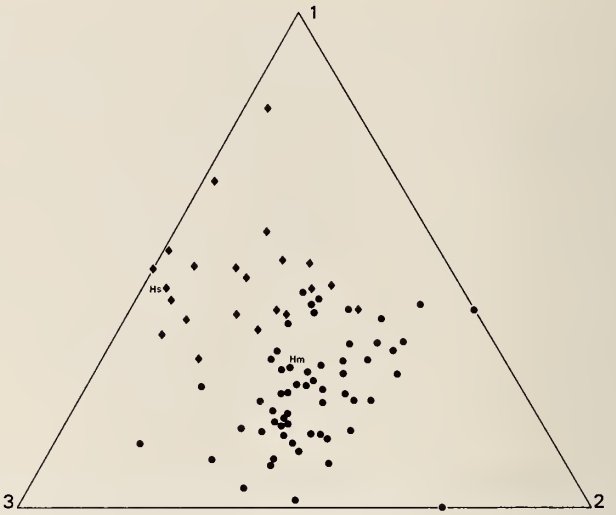


Figure 10

Triaxial plot of scores on first three principal components of 82 adult specimens of *Helminthoglypta* ***salviae***, coded as described in text. Diamonds, *H.* ***s. salviae***; circles, *H.* ***s. mina***; Hs, holotype of *H.* ***s. salviae***; Hm, holotype of *H.* ***s. mina***. Each symbol represents one or more specimens.

number are strongly associated (all pairwise correlations 0.808 or greater). The second principal component expresses umbilical size; a high score indicates a shell with a large umbilicus, both in absolute terms and relative to the diameter of the shell. Relative height (H/D) loads negatively on this factor. Both H/D and U/D load positively on the third factor; a high score indicates a relatively high shell with a relatively large umbilicus.

The summary statistics of the scores of the two subspecies on these three factors (Table 3) indicate that specimens of *Helminthoglypta* ***s. salviae*** tend to score higher on Factor 1, lower on Factor 2, and moderately lower on Factor 3 than specimens of *H.* ***s. mina***. The combination of a high score on Factor 1 and a low score on Factor 2 (signifying a large, relatively high shell with a relatively small umbilicus) is especially characteristic of *H.* ***s. salviae***.

On Figure 10 the scores of the measured specimens on the first three principal components are plotted on a triaxial graph. Factor scores were coded by adding the quantity necessary to set the lowest score on each factor to zero; a specimen's score on an axis of the graph is its corresponding coded factor score expressed as a percentage of the sum of its three coded factor scores. The two subspecies are well discriminated, with shells of *Helminthoglypta* ***s. salviae*** tending to score higher on the first axis and lower on the second axis than shells of *H.* ***s. mina***. The spread of both subspecies along the third axis is similar.

Table 2

Factor loadings of variables and eigenvalues of factors in principal components analysis of shells of *Helminthoglypta* ***salviae***. Unrotated factors are principal components.

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
D	0.909	0.351	−0.126	−0.175	−0.054
H	0.982	0.006	0.068	−0.152	0.087
W	0.879	0.268	0.041	0.391	−0.002
U	0.125	0.962	0.223	−0.087	−0.031
H/D	0.328	−0.755	0.566	−0.030	−0.031
U/D	−0.597	0.725	0.338	0.025	0.035
Eigenvalue	3.045	2.217	0.507	0.216	0.014

Soft Anatomy

Six specimens of *Helminthoglypta* ***s. salviae*** and one of *H.* ***s. mina*** were dissected. The figured reproductive systems are drawn from stained whole mounts.

Table 3

Summary statistics of factor scores in principal components analysis of shells of *Helminthoglypta* ***salviae.***

Subspecies	Factor 1	Factor 2	Factor 3
H. ***s. salviae***			
Mean	0.6742	−1.2336	−0.1175
Maximum	1.802	0.343	2.391
Minimum	−0.136	−2.233	−1.903
H. ***s. mina***			
Mean	−0.2472	0.4523	0.0431
Maximum	2.101	2.057	3.544
Minimum	−1.952	−1.028	−2.382

The body is slaty gray, the mantle collar light tan. The mantle over the lung is light tan with black spots covering about 30–40% of the surface, mostly discrete but somewhat confluent along the dorsal edge. There is a 1 mm by 3 mm patch of black pigment immediately behind the dorsal end of the mantle collar.

The reproductive system (Figures 7, 8) is typical of the nominate subgenus, with a short atrium. The atrial sac is about ⅔ the length of the vagina and bears a rather small dart sac at its proximal end. The mucus gland bulbs are of moderate size, joined by a thick-walled, Y-shaped common duct that enters the atrial sac at the base of the dart sac. The duct of the spermatheca is fine, somewhat cavernous at its base, and bears a moderately long diverticulum of greater diameter than the duct itself. The penis has a short, conical lower chamber and a long, double-walled upper chamber, leading to an epiphallus of the same diameter as the penis. The epiphallic caecum ("flagellum") is long for the size of the animal.

Remarks

Helminthoglypta ***salviae*** is the only species of *Helminthoglypta* thus far found in its immediate area. *Helminthoglypta* (*Helminthoglypta*) *cuyama* Hanna & Smith, 1937, occurs approximately 80 km to the west, in the valley of the Cuyama River (PILSBRY, 1939) and in Colson Canyon, Santa Barbara County (WBM, LACM). *Helminthoglypta cuyama* is larger (to almost 29 mm diameter), also glossy and depressed, but has malleate sculpture instead of fine spiral striation; its peristome is reflected. The mantle over the lung is very dark, 90% or more covered with black pigment flecks, almost uniform over the last ¼ whorl but breaking up into spots behind that. The epiphallic caecum is shorter than that of *H.* ***salviae*** even though the adult animal is larger, and the dark sac is larger in diameter than the atrial sac.

The enigmatic *Helminthoglypta cuyamacensis venturensis* (Bartsch, 1916), described from Ventura County but never subsequently recognized, differs from *H.* ***salviae*** in being coarsely, densely papillose all over. It seems highly improbable that *H. c. venturensis* is really a subspecies of *Helminthoglypta* (*Rothelix*) *cuyamacensis* (Pilsbry, 1895), but until the species is rediscovered and living material dissected it cannot be firmly allocated.

To the east the geographically nearest taxon is *Helminthoglypta* (*H.*) *traskii tejonis* Berry, 1930, from rockslides in the vicinity of Fort Tejon, Kern County, with a large, tumid, low-conic shell, reaching a maximum diameter of over 30 mm. Also in the vicinity of Fort Tejon have been found specimens resembling *Helminthoglypta* (*H.*) *traskii traskii* (Newcomb, 1861), one of which was figured by PILSBRY (1939:fig. 85f). Shells that I have examined are of about the same shape and size as presumed topotypic *H. traskii traskii* from Point Fermin, Los Angeles County, but the incised spiral sculpture is finer (7 striae/mm on the last ¼ of the body whorl as compared to 4 or 5 striae/mm on *H. traskii traskii*). It is possible that these specimens represent an eastern occurrence of *H.* ***salviae***. If they are *H. traskii,* then dissected material should show the rather large subglobular dart sac found in that species.

The range of *Helmithoglypta* ***salviae*** is within Juniper-Pinyon Woodland (KÜCHLER, 1977), characterized by open, mixed groves of California juniper (*Juniperus californica* Carr.) and singleleaf pinyon (*Pinus monophylla* Torr. & Frém.), both of which here range from large shrubs to small trees. *Yucca whipplei* Torr. is locally common, and the moist interior of its decaying clumps forms prime snail habitat. East of Frazier Park, *H.* ***s. mina*** was found in clumps of *Y. whipplei* in overgrazed pasture. West of Frazier Park, *H.* ***s. mina*** occurs in open areas in an ecotone between Juniper-Pinyon Woodland and Southern Jeffrey Pine (*Pinus jeffreyi* Grev. & Balf.) Forest. We did not find any *Helminthoglypta* in pure stands of Jeffrey pine.

ACKNOWLEDGMENTS

I am grateful for the aid and field companionship of Eric Hochberg and Paul Scott. Tim Pearce kindly put specimens at my disposal. The computer-assisted analysis was performed with the help of David R. Lindberg and Tim Pearce. Dick Reeder read and commented on the manuscript. I especially acknowledge the collaboration of Walter B. Miller, who collected, dissected, and drew many of the specimens and identified the *Salvia* at the type locality of *Helminthoglypta* ***salviae***.

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